Preparation of a 3D Dunedin Velocity Model

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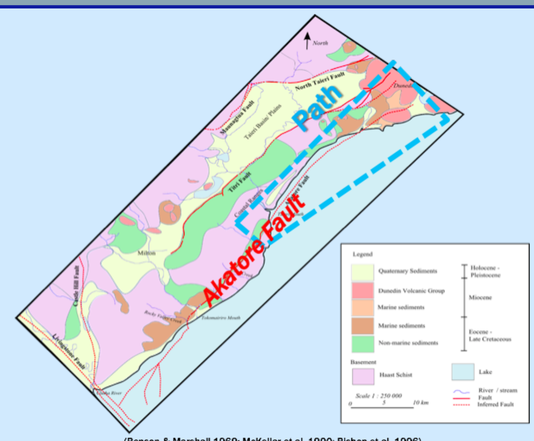
Motivation

The Akatore Fault is a significant source of seismic hazard for the Dunedin[1–3]. We hope to use ground motion simulations to estimate the likely levels of earthquake shaking that could impact the city in a future Akatore Fault earthquake. These require numerical models of source (Akatore Fault), path (the geology between the Akatore Fault and Dunedin), and site (the geology of the Dunedin CBD). This poster presents work towards defining the path for an Akatore earthquake simulation in Dunedin city.



(Benson & Marshall 1969; McKellar et al. 1990; Bishop et al. 1996)

Seismic Data Collection and Analysis

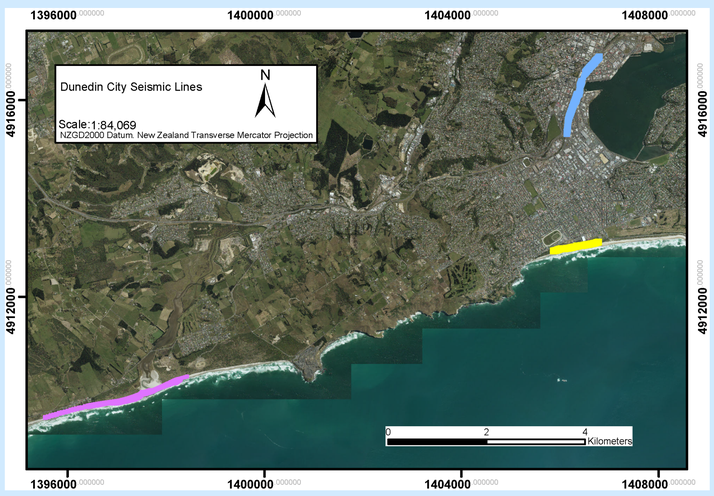


Figure 1: Seismic data acquisition locations: Kaikorai estuary (pink), Railway corridor (blue), and Kettle Park (yellow).

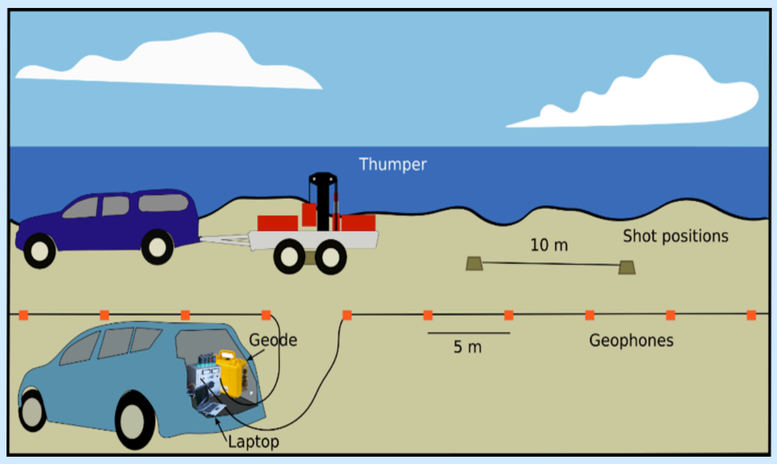


Figure 2: Seismic data collection. Standard set up including seismic source ("Thumper"), geophones, and seismographs.

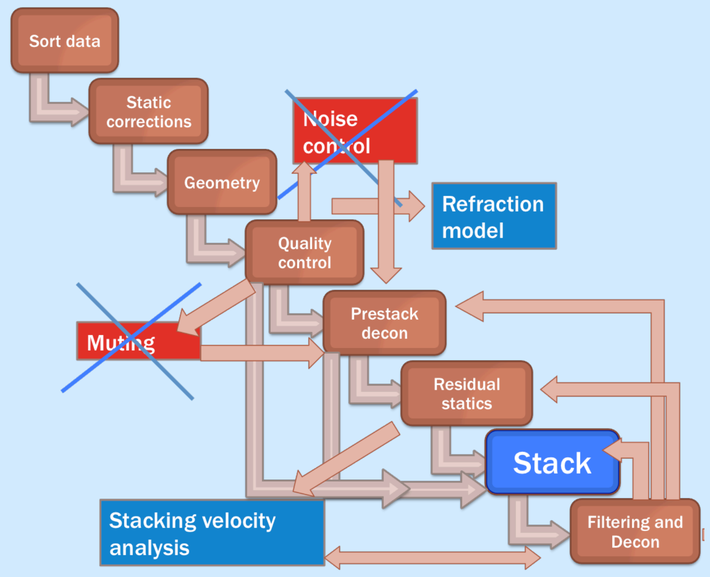


Figure 3: Seismic data processing flow[4]. Key outputs: stacked reflection profile, stacking p-wave velocity model and refraction p-wave velocity model.

Seismic Data Results

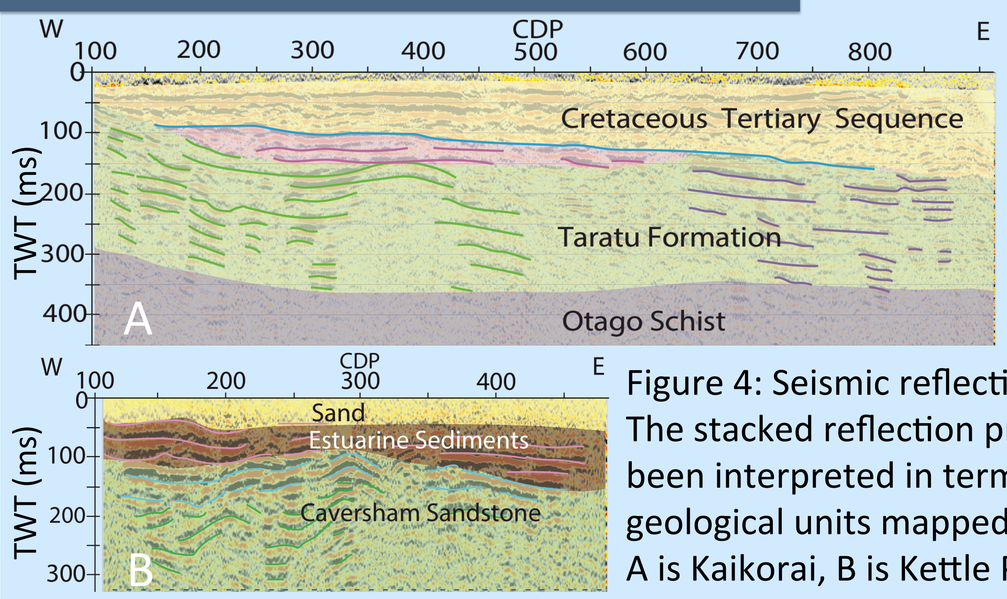


Figure 4: Seismic reflection profiles. The stacked reflection profiles have been interpreted in terms of geological units mapped onshore. A is Kaikorai, B is Kettle Park.

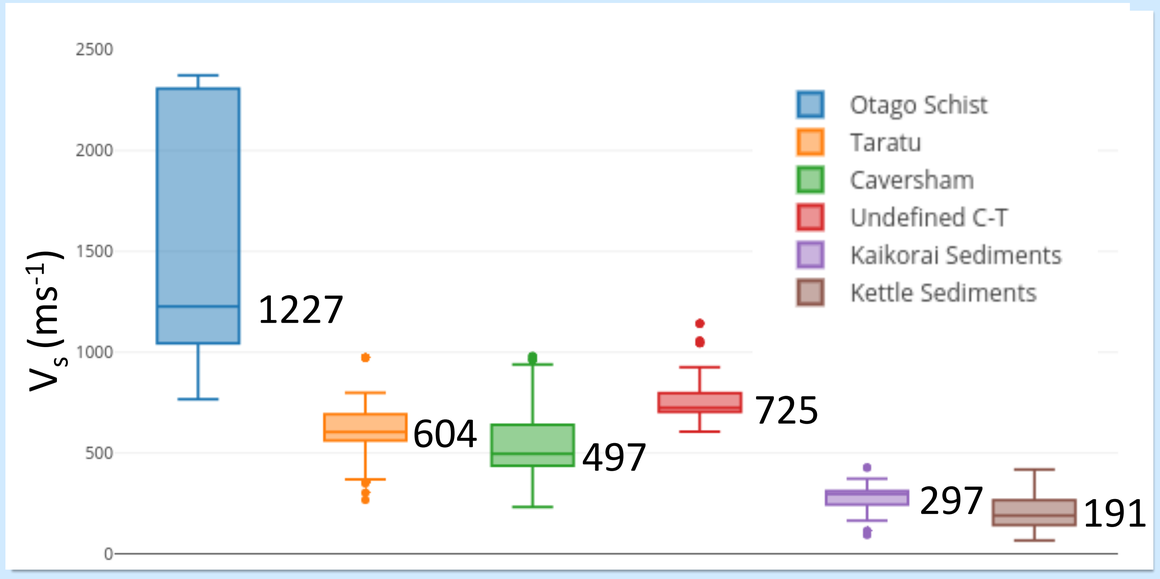
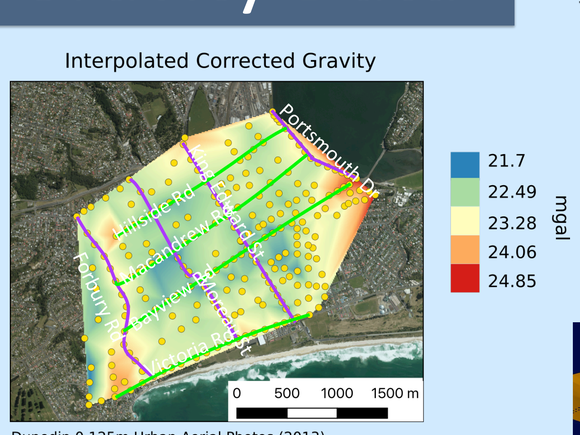


Figure 5: S-wave velocities of units. The p-wave velocities have been used to calculate s-wave velocities using an empirical relation[5].

Gravity Data



Dunedin 0.125m Urban Aerial Photos (2013)

Figure 6 : Lutters (2018)[6] original data interpolated across south Dunedin. Lines show 2D profiles in fence diagram (figure 8).

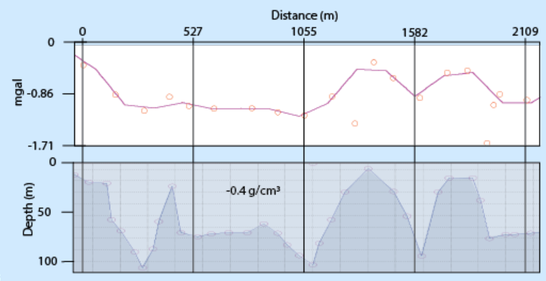


Figure 7 : GRAVCADW 2D forward modeling process.

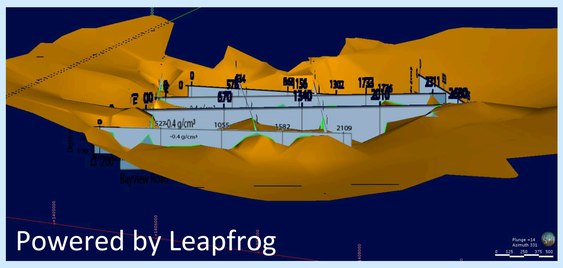


Figure 8: Gravity profile fence diagram and resulting 3D surface.

Model Building

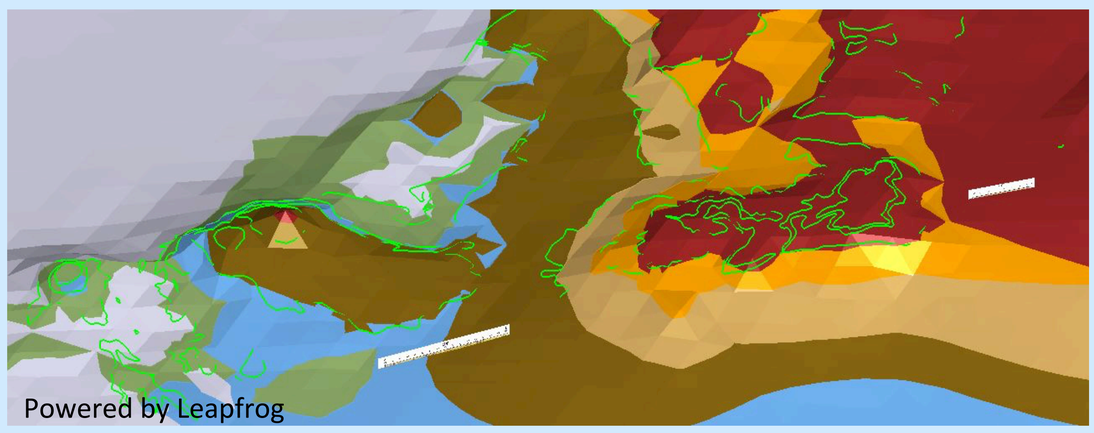


Figure 9: Volumes generated in Leapfrog using the data collected. Purple is Otago Schist, green is Taratu Formation, blue, brown, and beige are Tertiary sediments, orange is Caversham Sandstone and red is Dunedin Volcanic Sequence. Ask Catherine for a video tour!

References

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Acknowledgements

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